

The thematic assessment report of **INVASIVE ALIEN SPECIES AND THEIR CONTROL**²

Prepared by the co-chairs and technical support unit of the assessment

7/ Climate change and biological invasions³



ipbes

Overview

Invasive alien species are recognized as one of the five major direct drivers of change in nature globally, alongside land- and sea-use change, direct exploitation of organisms, climate change, and pollution {Introduction}⁴.

The threats from invasive alien species are increasing markedly in all regions of Earth, with the current unparalleled high rate of introductions predicted to rise even higher in the future {KM-B2}.

Climate change may lead to future increases in the establishment and spread of invasive alien species (*established but incomplete*) {B12}.

Awareness of the risks of biological invasions will contribute to the effective delivery of several of the Sustainable Development Goals, including climate change (Goal 13) {KM-D4}.

1. This factsheet is part of a series of factsheets, which highlight a selection of key elements on specific themes from the Summary for Policymakers of the IPBES Assessment Report on Invasive Alien Species and their Control. For further information and context, please consult the Summary for Policymakers and Chapters of that Assessment Report.

2. IPBES (2023). Summary for Policymakers of the Thematic Assessment of Invasive Alien Species and their Control of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Roy, H.E., Pauchard, A., Stoett, P., Renard Truong, T., Bacher, S., Galil, B.S., Hulme, P.E., Ikeda, T., Kavileveetil, S., McGeoch, M.A., Meyerson, L.A., Nuñez, M.A., Ordóñez, A., Rahlao, S.J., Schwindt, E., Seebens, H., Sheppard, A.W., Vandvik, V. (eds.). IPBES secretariat, Bonn, Germany. <https://doi.org/10.5281/zenodo.7430692>

3. <https://doi.org/10.5281/zenodo.10408375>

4. The references enclosed in curly brackets (e.g., {KM-C1, B11}) are traceable accounts and refer to sections of the Summary for Policymakers of the IPBES Assessment of Invasive Alien Species and their Control. A traceable account is a guide to the section in the summary for policymakers and the chapters that contains the evidence supporting a given message and reflecting the evaluation of the type, amount, quality, and consistency of evidence and the degree of agreement for that statement or key finding.

Climate change will further exacerbate the establishment and spread of some invasive alien species

Definition of biological invasions

The term “biological invasion” is used to describe the process involving the intentional or unintentional transport or movement of a species outside its natural range by human activities and its introduction to new regions, where it may become established and spread. Species introduced to new regions through human activities are termed alien species. Invasive alien species represent a subset of alien species known to have established and spread with negative impacts on biodiversity, local ecosystems and species. Many invasive alien species also have impacts on nature’s contributions to people and good quality of life {Introduction}.

Climate change is also predicted to enhance the competitive ability of some invasive alien species and to extend areas suitable for them thus offering new opportunities for introductions and establishment (*established but incomplete*) {B13}.

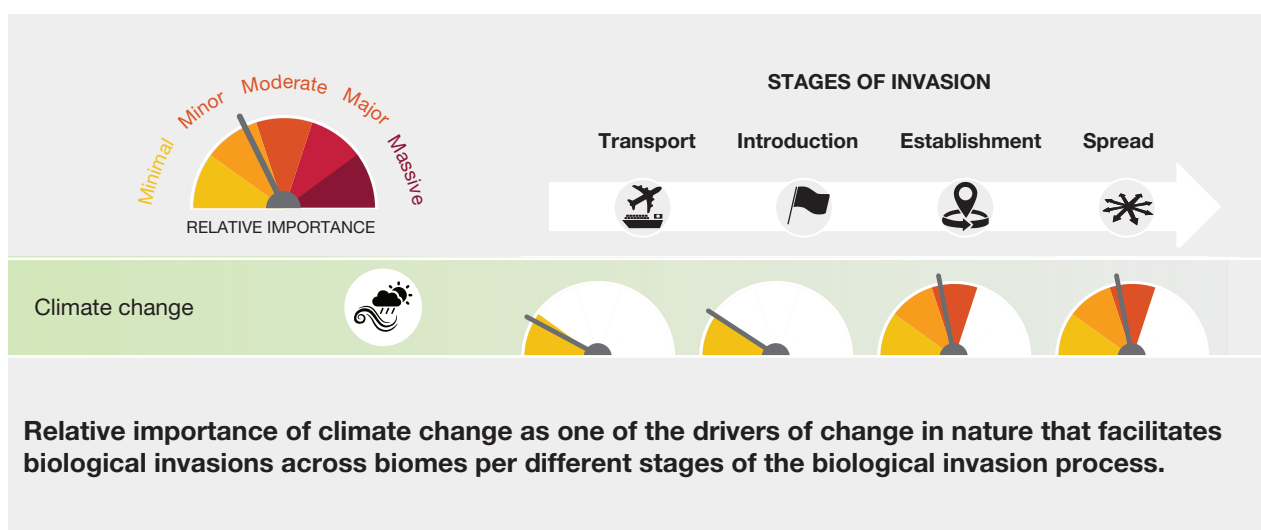
Islands are also vulnerable to climate change, which can increase the rate of establishment and spread of many invasive alien species (*well established*) {A3}.

There can be significant time lags in the response of invasive alien species to various drivers because the underlying processes that facilitate biological invasions operate at varying temporal scales (short- to long-term) (*well established*) {B14}.

Climate change is predicted to lead to major changes in land- and sea-use and, in some regions, in human migration patterns (*established but incomplete*) {B13}, but also to more extreme events among natural drivers, such as droughts, floods, wildfires, tropical storms and oceanic storm waves (*established but incomplete*) {B13}.

Delays in the response of invasive alien species to drivers of change may result in a long legacy of future biological invasions due to past and present amplification of drivers {KM-B3}.

Climate change, along with the continued intensification and expansion of land-use change may lead to future increases in the establishment and spread of invasive alien species in disturbed habitats and in nearby natural habitats (*established but incomplete*) {B12}.



Relative importance of climate change as one of the drivers of change in nature that facilitates biological invasions across biomes per different stages of the biological invasion process.

Understanding and addressing the impacts of invasive alien species in the context of climate change

➤ Climate change can increase the magnitude of impacts of invasive alien species

Invasive alien plants, especially trees and grasses, can sometimes be highly flammable and therefore promote more intense and frequent fire regimes, causing increased risks to nature and people and increased carbon release into the atmosphere (*well established*) {B13}. Certain invasive alien plants, such as shrubs and trees, can reduce water availability, especially in scenarios of increasing drought caused by climate change {Box SPM.4}.

The zebra mussel (*Dreissena polymorpha*) has been implicated in the transfer of botulinum toxin to higher trophic levels, which has been further facilitated by climate change, specifically by increased water temperatures, leading to mortality of waterfowl in the Great Lakes {Box SPM.2}.

➤ There are complex interactions and feedback among direct and indirect drivers of change

The magnitude of the future threat from invasive alien species is difficult to predict because of complex interactions and feedback among direct and indirect drivers of change in nature {KM-B4}.

Climate change interacting with land- and sea-use change is predicted to profoundly shape and amplify the future threat from invasive alien species {KM-B4}.

Some of the highest current rates and greatest magnitudes of biological invasion occur where land-use change interacts with one or more additional drivers (*established but incomplete*) {B13}. For example, interactions among land-use change, climate change and nutrient pollution have driven the introduction, establishment and spread of *Pontederia crassipes* (water hyacinth) across Africa (*well established*) {B13}.

➤ Management and governance of biological invasions in the context of climate change

Adaptive management, possibly combining multiple options, will improve management of biological invasions under ongoing climate and land-use change {KM-C5}. The integration of site- and/or ecosystem-based management, including ecosystem restoration, can improve management outcomes, enhancing ecosystem function and resilience to environmental change, including future invasive alien species, especially under climate and land-use change (*well established*) {C21}.

An integrated governance approach that acknowledges the interactions between invasive alien species and other drivers, including climate change, direct exploitation of natural resources, pollution and land- and sea-use, alongside human, animal and plant health, can identify where to best direct policy alignment and mutually supportive efforts (*established but incomplete*) {D33}.

Awareness of the risks of biological invasions will contribute to the effective delivery of several of the Sustainable Development Goals, especially those addressing the conservation of marine biodiversity (Goal 14) and terrestrial biodiversity (Goal 15, including but not restricted to Target 15.8), food security (Goal 2), sustainable economic growth (Goal 8) and sustainable cities (Goal 11), as well as climate change (Goal 13) and health and wellbeing (Goal 3) (*established but incomplete*) {KM-D4, D33}.

GAP	IMPLEMENTATION CHALLENGE		POTENTIAL GAIN	
	Estimated research cost	Estimated scientific challenge	For taking management action	For better understanding biological invasions
Lack of understanding of the net effects of multiple interacting drivers in shaping and promoting biological invasions {3.5, Box 3.10, 3.6.1, Box 3.13}	●	●	●	●
Lack of knowledge on interactions and feedback across drivers in promoting invasions {3.1.5, 3.6.1}	●	●	●	●
Comparative lack of understanding of the drivers of change that facilitate biological invasions in developing economies {Box 3.12}	●	●	●	●
Lack of data and knowledge of the drivers of biological invasions in sub-Saharan Africa, tropical Asia and South America {3.6.1}	●	●	●	●
Poor understanding of drivers of change that facilitate biological invasions in aquatic and marine systems {3.6.1}	●	●	●	●
Lack of scenarios and models of invasive alien species that consider interactions with other drivers of global change {2.6.5, 6.6.1.6}	●	●	●	●
Incomplete data to prioritize biological invasion management under climate, sea- and land-use change {5.6.1.3}	●	●	●	●
Lack of understanding of and mechanisms for sharing knowledge on invasive alien species and their drivers, impacts, management and governance among Indigenous Peoples and local communities and researchers and other outsiders {6.6.1.5}	●	●	●	●

● VERY LOW
● LOW
● INTERMEDIATE
● HIGH
● VERY HIGH

Gaps in knowledge and data regarding invasive alien species and their control

Synthesis of some of the most important knowledge and data gaps identified in the assessment.